

APPENDIX A

A-1: Detailed Data Collection and Conversion Methodology

A-2: Natural Resource Inventory (NRI) Metadata

A-3: Shape Files Used for the Kansas City NRI GIS Program

Appendix A-1: Detailed Data Collection and Conversion Methodology

To complete data collection for the ecological classification and inventory for the Kansas City region, AES completed the following tasks:

- A. **Data Assembly and Mapping:** digital information from several government sources was used to establish baseline information about land cover in the region.
- B. **Field Reconnaissance:** The digital information was validated and/or refined through field inspections and verifications.
- C. **Ecological Land Cover Classification Development:** Using data from the data assembly and subsequent field reconnaissance, AES created an ecological classification representing existing natural resources in the region, a GIS-based information database, and a regional map of ecological land cover.
- D. **Data Extrapolation and Second Field Verification:** The ecological classification involved an iterative process in which initial data were assembled, evaluated in the field, revised, and then re-evaluated in the field a second time. Final data were assembled after the second field reconnaissance, evaluated, and incorporated into the GIS program and the regional land cover map.

Details of how data was compiled and utilized for this project are described below.

Data Assembly and Mapping

One of the primary objectives of the Kansas City Natural Resources Inventory was the compilation of extensive amounts of data from a variety of source that could be used as a baseline for the natural resources inventory and from which to build a comprehensive GIS program. As the project began, and data sources were accessed and compiled into the program database, it was found that a lack of comprehensive, up-to-date data sets existed. These data sets were needed to create a consistent and complete region wide ecological land cover classification and natural resources inventory. While both Missouri and Kansas and their many different agencies have extensive geographical and land use data sets that provide data of different resolutions, accuracies, and formats, AES determined that the information and data available from the states would require close examination and testing to assess its quality for use in the Kansas City Natural Resource Inventory.

To overcome potential data quality issues, AES examined existing land cover classifications and existing natural resource data and tested the mapping results against recent digital orthophotos of the Kansas City Metropolitan Area. From this process, it was discovered that a “Triage” approach was necessary for project success. This approach would map different counties to different resolutions dependent upon existing data availability and coherency. Our examination of data determined that Johnson County, Kansas and Jackson County, Missouri had the most detailed and consistent data. Cass, Clay and Platte Counties, Missouri had less detailed information than Johnson and Jackson Counties, and Ray County in Missouri and Leavenworth and Wyandotte Counties in Kansas were found to have the lowest resolution data and were mapped similarly.

Land cover data was considered acceptable based on its ability to correctly distinguish a uniform patch of land surface on digital orthophotos (e.g., forest, grassland, urban) and correctly match the edges of the digitized polygon to that land surface patch. Based on this examination, AES found GAP data to be the most accurate and consistent when compared at a multi-county, multi-state level.

While available for both Missouri and Kansas, each state used a different GAP classification. In order to join these classifications and create a regional ecological land cover classification, AES created a two-level classification linked to the two GAP classifications (Table 1 of the “Ecological Land Cover Classification for a Natural Resources Inventory in the Kansas City Region, USA” report). This approach to combining different classifications is termed a “crosswalk.”

The final Crosswalk Classification for this study (CLASS_URBF) included the following:

Aquatic Communities

Open Water: Standing water for a significant part of the year.

Natural Communities –Lowland

Lowland Hardwood Forest and Woodland: Open to closed forest canopy in flooded or wetland areas.

Marsh and Wet Herbaceous Vegetation: Wetlands without a closed canopy; includes brush and scattered trees.

Natural Communities –Forest

Deciduous Forest: Mostly closed canopy of deciduous trees, often mature; includes former savannas on south to west slopes.

Mixed Evergreen-Deciduous Forest: Open to mostly closed canopy of junipers and deciduous trees, often oaks; may include form savannas

Natural Communities –Grassland-Savanna-Woodland

Deciduous Woodland/Immature Forest: More open canopy of deciduous tress, often mature.

Grassland: Often containing native wild plants; may include CRP plantings.

Cultural or Sparsely Vegetated Land

Urban Forest: Deciduous canopy cover within an urbanized location (Specific to Jackson/Johnson Counties)

Cultural Grassland: Grassland of planted domesticated grasses, or formerly cultivated land reverting to grassland and sometimes brush.

Agricultural Land: Used as farmland (Specific to Jackson/Johnson Counties)

Cultivated Land: Used as cropland

Developed Land: Urban and suburban land uses, including homes, businesses and roads. Areas mapped may contain natural vegetation.

Unclassified: Insufficient data to classify.

In order to classify data into the crosswalk classification the following methods were used.

1. “Developed” or “Undeveloped” Classification

Developed lands were the first class assigned and delineated within the NRI classification. This class is the most accurate spatially and temporally because of the source data availability. Because of its accuracy and consistency within the project area the developed land class was set to override all other classes. Once developed and undeveloped lands were distinguished the undeveloped lands class were further dissected.

1.1. Developed Classification defined: “Urban and built-up areas”

A Land Cover/Use category consisting of residential, industrial, commercial, and institutional land; construction sites; public administrative sites; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water control structures and spillways; other land used for such purposes; small parks (less than 10 acres) within urban and built-up areas; and highways, railroads, and other transportation facilities if they are surrounded by urban areas. Also included are tracts of less than 10 acres that do not meet the above definition but are completely surrounded by urban and Built-up land. Two size categories are recognized in the NRI: (i) areas 0.25 to 10 acres, and (ii) areas greater than 10 acres. [NRI-97]

<http://www.nrcs.usda.gov/technical/land/meta/m5885.html>

2. Two Methods for Defining Developed Lands

Two methods were used in the classification of “developed” and “undeveloped” lands. (1) Parcel size and parcel use (cadastral data) provide the required information necessary to classify “urban area” according to NRCS’s definition (below). (2) The average distance from a road provides the second approach taken to define “developed land.”

2.1 Cadastral Method

Of the two methods, the cadastral data (parcel size and tax use values) is perhaps the most accurate and highly resolved method of classification. Because cadastral data is used for tax assessment purposes the data is developed to a set of minimum standards which are very similar across the study area. The spatial accuracy of any parcel may vary according to the data and survey methods used. The older methods are generally the least accurate. Even with this cadastral mapping variability the overall spatial accuracy of the cadastral data is significantly greater than any other land use source data available for this project. Because taxation is an annual event, parcel data is updated each time the parcels are sold and subdivided. The temporal accuracy of the data is generally accurate to within 1 year of the acquisition data (often accurate to the data of purchase) unless earlier versions are requested.

2.1.1. Redefining Urban Areas for Use with Cadastral Data

Johnson, Clay and Cass Counties were the only counties to provide workable tax use values (Further work and discussion with the various counties will be required to extract these codes

and their descriptions.). The tax use values can be very valuable for projects like this one because they describe the primary use of the property for tax purposes. Thus, smaller parcels used for higher intensity uses such as residential homes, commercial properties, industrial properties, etc., are more than likely developed. As parcels increase in size the reliability of the “use class” decreases as some parcels may have multiple uses or certain portions of a parcel may have a secondary or multiple different uses not defined by the use class value. Larger parcels should be reviewed and reclassified accordingly. Parcels less than or equal to 10 acres were defined as “developed”. All parcels greater than 10 acres that were not specifically defined as commercial, industrial or some other developed category were defined as “undeveloped.”

2.1.1.1. Cadastral Data Availability

Cadastral data was not available for all of the counties in the study area. As the map development began only one county had provided cadastral information. Currently all counties but one (Ray) have provided some form of cadastral data. Jackson County data has only provided geographical subsets of its attribute data (including tax use). Other counties have not provided the appropriate attribute data to perform this analysis. As a result, other methods for defining developed areas were required for this study.

It may be useful to develop a GIS users group of key county officials and GIS staff in order to support the efforts of the various county mapping departments and their staff. Regular meeting would help MARC explain and demonstrate the value of cooperation in meeting the mapping needs of the region. The publication of annual map and data products would help support the efforts of individual GIS departments to develop and enhance their data development and distribution efforts.

2.1.1.2. Updating NRI Developed Lands

We strongly recommend that you pursue the acquisition of the cadastral data and the related attribute information required to map “urban and built-up areas” using this method. The use of this data is the least expensive and most accurate method to update the NRI annually. Changes in developed lands represent the continuing encroachment of development on the natural resource inventory.

2.1.1.3. Urban Area/non-Urban Area Map

An Urban Area/Non-Urban area map, a subset of the NRI map, can easily be generated from cadastral data. Change in urban area (using parcel size metric) can be measured accurately, reliably and regularly. Annual updates of this map will provide a visual presentation and data that decision-makers and the public can understand. Increases in urban area reflect reductions in the various natural resource classes.

2.2 Roadless Areas

The “roadless area method” is the second method used to classify developed land. This method is less accurate than the cadastral method and is used when cadastral data is not available and when the accuracy of the road centerline data is reasonable, i.e. when there are few omissions in the road centerline network and when road centerlines accurately overlay current orthorectified aerial photos as shown in Figure 1 below.



Figure 1. 911 Road centerlines overlay 2001 aerial photos with reasonable accuracy. In a few areas the centerlines were not as accurately depicted as here.

Road metrics are ideal indicators of development which includes impervious surface area and hydrologic segmentation. Roads are built to provide access. On forested land, temporary roads are needed for timber extraction and management. Agricultural land requires more permanent roads for intensive cultivation and livestock management. Residential and commercial areas require greater road densities to service smaller properties that support larger populations. Greater overall road density in a study area indicates greater intensity use of the land.

In addition to their contribution to impervious surface area, the abundance, longevity, and spatial characteristics of roads affects the natural drainage system. They modify natural drainage patterns within a watershed, creating artificial, segmented hydrologic systems. They function as dikes and dams, containing and directing water into and out of these artificial basins. Overland flows enter and exit these basins through breeches in the system, e.g. culverts and bridge openings.

2.2.1 Roadless Areas Defined

Roadless area polygons are bounded by roads and railroads generated from road and railroad GIS centerline data. The road network was converted from a vector line file into a polygon theme in which the roads and railroads serve as the boundary lines of the polygons. Only centerlines that create a closed boundary around unroaded areas are converted into polygons. Cul-de-sac and other dead-end streets and roads are not incorporated into the resulting metrics. These disconnected or dangling line segments do represent important access into roadless areas. Distance from a road grid metric was used to better characterize the roadless polygon areas. Below in figure #2 you see a distance grid with the roadless polygon overlaid. Red represents a least distance from a road while blue represents a furthest distance. The black lines are the roadless polygon boundaries.

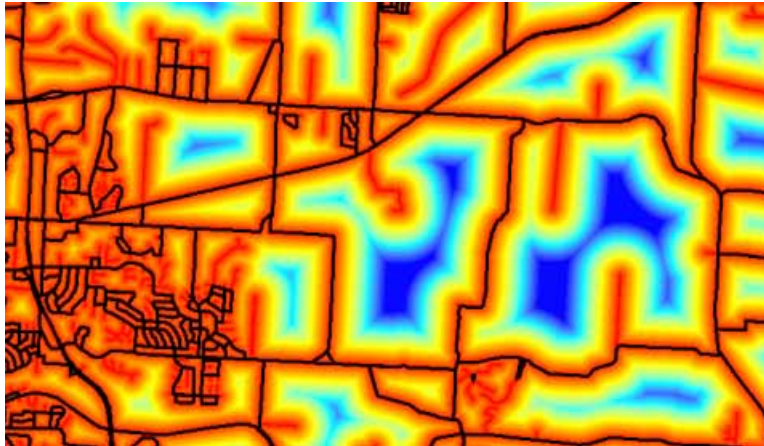


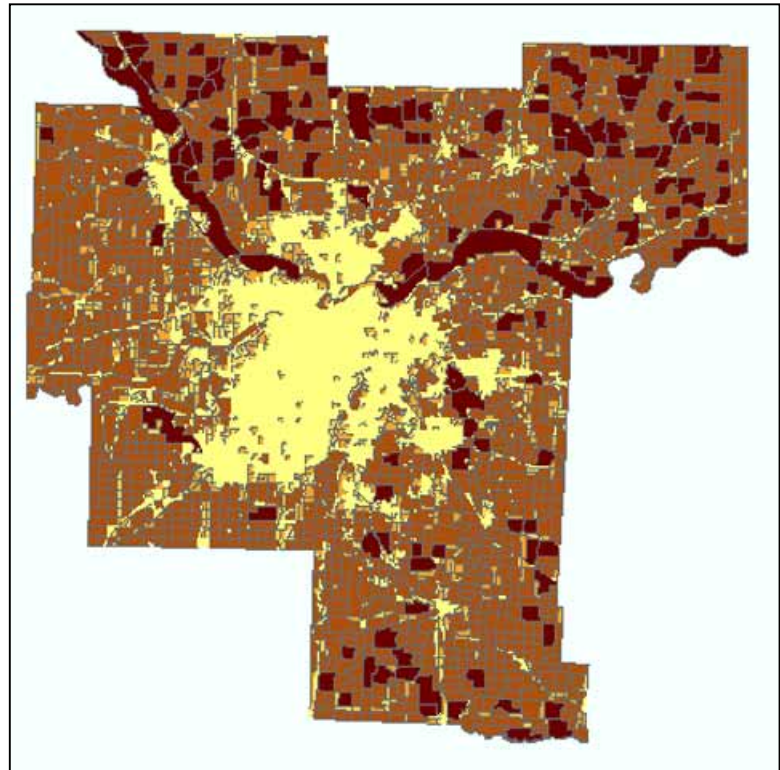
Figure 2. The use of grid distance from roads incorporates the access issues presented by cul-de-sacs and dead end roads that are not addressed with roadless polygon metrics. Blue areas identify the greatest distances from roads.

Using the zonal statistics function within the spatial analysis extension we were able to extract summary grid distance statistics for each roadless polygon. The average distance from a road and the maximum distance from a road were added to the roadless polygon file. The resulting roadless polygon mapped below identifies the roadless areas with the maximum distance from a road of less than 300 meters in yellow. These polygons are most often associated with developed land. Polygons with a maximum distance from a road greater than 300 meters are less often associated with developed areas.

Field	Value
FID	13382
Shape	Polygon
ACRES	1625.286
HECTARES	657.733
ROADRR_ID	13383
AREA	6577325.359
PERIMETER	11686.481
MAXRDDIST	834.7
AVERDDIST	286.3

Figure 3. Summary statistics for each roadless polygon such as the maximum distance to a road within a polygon are linked and coded to the roadless polygon record.

Figure 4. Roadless polygon techniques identifies more developed areas (shown in yellow). The areas in yellow have a maximum distance to a road of 300 meters. This measurement roughly corresponds to the NRCS metric defining urban areas of parcel clusters of 10 acres or less. Road centerline data is developed and maintained by Mid-America Region of Governments and is available internally to MARC.



2.2.2. Roadless Area Maps

An Urban Area/Non-Urban area map, a subset of the NRI map, can easily be generated from road centerline data. Change in urban area (using parcel size metric) can be measured accurately, reliably and regularly. The resolution and accuracy of the road centerline data is less than from cadastral data. However, updates of this map will provide a visual presentation and data that decision-makers and the public can understand. As with the cadastral version of this map, increases in urban area reflect reductions in the various natural resource classes.

3. High Resolution Forest Cover

In Jackson and Johnson County we have very accurate forest cover GIS files. In Jackson County the data was generated from the aerial photo interpretation process. In Johnson County the forest cover data was provided by the County.

4. Land Cover Data

Various sources of land use land cover data was inventoried and assessed for accuracy, precision, usability and consistency from a spatial and temporal perspective. It was determined that GAP Land Cover data was the most appropriate for this project.

4.1. Land Use and Land Cover (LULC)

Land Use and Land Cover (LULC) data from the USGS was one of the data layers inspected. LULC data consisted of historical land use and land cover classification data based primarily on the manual interpretation of 1970's and 1980's aerial photography

(<http://edc.usgs.gov/products/landcover/lulc.html#top>). This information could be used as a data source for change analysis. The resolution of the data fits comfortably well with NLCD or GAP data described below. Because the coverage is more than 20 years old it was not used in the development of the current natural resource maps.

4.2. The National Land Cover Characterization (NLCD)

Also reviewed was the National Land Cover Characterization (NLCD) project. The project was created in 1995 to support the original Multi-Resolution Land Characterization (MRLC) initiative and fulfill the requirement to develop a nationally consistent land cover data set from MRLC data called National Land Cover Data 1992 (NLCD 92). Additional information about the project can be found at: <http://landcover.usgs.gov/nationallandcover.asp>.

According to product description on the USGS NLCD web site the land cover data results from the early to mid-1990s Landsat Thematic Mapper satellite data with a 30 meter resolution." The unsupervised classification was labeled using "relatively small numbers of aerial photography for ground truth." Leaf-off and leaf-on imagery were combined in the classification process. Classification was performed at the state level often with a mosaic up to 18 TM scenes. The "reliability of the data is greatest at the state or multi-state level."

4.3. Gap Analysis Program (GAP)

Gap Analysis is a scientific means for assessing the extent native animal and plant species are being protected at a state, local, regional, or national level. One of the primary by-products of the GAP effort is a land use, land cover mapping data. The data was derive from satellite imagery similar to the NLDC data but has been refined specifically to identify natural community types. <http://www.gap.uidaho.edu/>. The National Gap Analysis Program or "GAP" function, according to its website at <http://www.gap.uidaho.edu/About/Overview/GapDescription/default.htm>, is to "provide broad geographic information on the status of ordinary species (those not threatened with extinction or naturally rare) and their habitats in order to provide land managers, planners, scientists, and policy makers with the information they need to make better-informed decisions"

Gap analysis is a method used to identify "the degree to which native animal species and natural communities are represented in our present-day mix of conservation lands. Those species and communities not adequately represented in the existing network of conservation lands constitute conservation gaps." The national effort brings state and national agencies together in an effort to map the following:

- Existing natural vegetation to the level of dominant or co-dominant plant species;
- predicted distribution of native vertebrate species;
- Public land ownership and private conservation lands
- The current network of conservation lands; and
- Distributions of any native vertebrate species, group of species, or vegetation communities of interest with the network of conservation lands.

Kansas Gap data was taken from TM data since 1995 to 2000 while the Missouri Gap data was taken from TM data from the 1991 to 1993. The vegetation mapping uses the National Vegetation Classification System (FGDC 1996). Several agencies are involved in the development of the GAP including the Biological Resources Division of the U.S. Geological

Survey, the Department of Defense, the Environmental Protection Agency and various state agencies. Other non-government partners include The Nature Conservancy.

The GAP work was conducted in Kansas by the State Biological Survey using a classification scheme prepared previously for the State (Lauver, Kindscher, Faber-Langendoen, and Schneider 1999). In Missouri land cover mapping and classification was prepared by an interagency team using the National Vegetation Classification introduced initially by The Nature Conservancy and later modified by a working group with The Ecological Society of America. Other classifications completed included those available on the DASC website in Kansas, and the MSDIS web site for Missouri. Further information is available on the Kansas GAP efforts at: <http://www.gap.uidaho.edu/Projects/States/Detail.asp?State=ks>

Further information is available on the Missouri GAP efforts at <http://www.gap.uidaho.edu/Projects/States/Detail.asp?State=mo>
<http://calmit.unl.edu/gapmap/>

4.4. Summary of Existing Land Cover Mapping Data

All of the data described above was developed for regional planning for use at a scale of 1:100,000 or smaller. None of these data fit the specific needs of this project. None of the data was of the desired resolution for more detailed planning in the MARC study area. The GAP data provided the best and most current cover data of these land cover sources. GAP data was used and refined where possible in the development of the NRI maps.

5. Johnson County Forest Cover

A detailed forest cover GIS boundary of Johnson County was provided by the county. The boundaries fit very well over the 2001 natural color aerial photography produced by AerialExpress. A description of the process used by the County to define forest cover was not provided but assumed to be an aerial photo interpretation process. The digital feature code (FEA_Code) "82" was used to represent forest cover in this project. According to additional codes the photography used in the forest cover classification was dated "1998."



Figure 5. The red boundary lines represent the forest cover boundaries in Johnson County.

These forest cover boundaries were used in the further classification of forest type.

6. Jackson County Forest Cover

Jackson County was used as a test case to determine the value of additional aerial photo interpretation work to map land cover from 2001 natural color aerial photographs. The photography was highly resolved (1 meter pixel resolution), was current to 2001 and covered a major portion of the MARC 8-county study area. This photography represented the best mapping data available for this study at the time. More recent natural color photography has been flown by AerialExpress since this study was initiated.

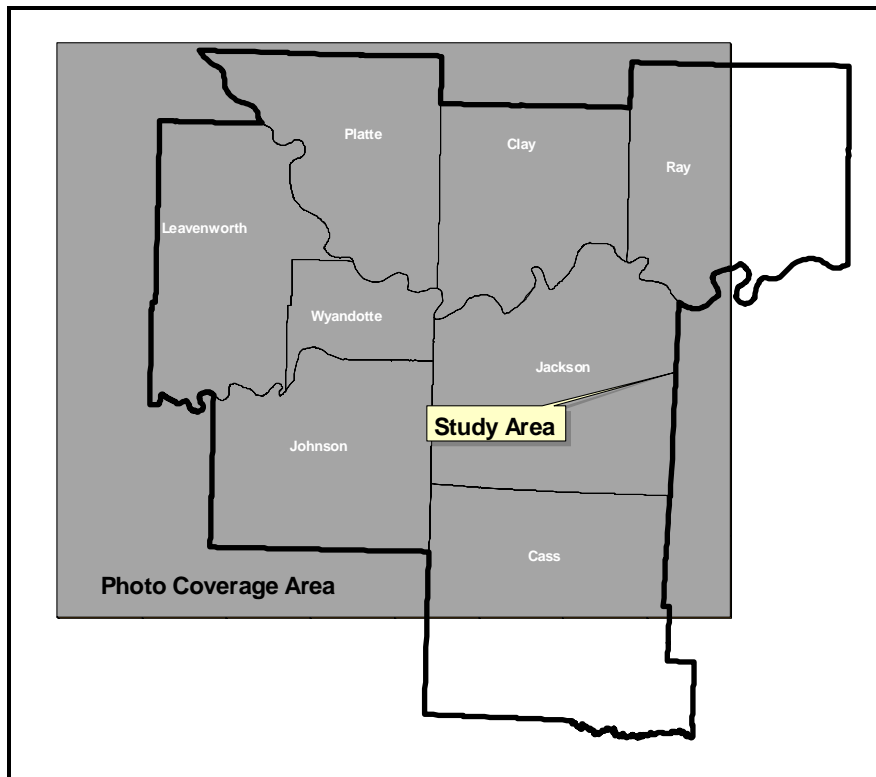


Figure 6. AerialExpress Aerial Photo Coverage area overlaid on the MARC 8-county study area. Portions of Ray and Cass counties in Missouri were not covered.

Additional information on this and more recent imagery can be found at Aerial Express.com's web site: <http://www.aerialsexpress.com/saleshome2.php3>.

6.1 Aerial Photo Classification Process of Forest Cover

Image classification methods were used to see if improvements could be made on the GAP forest cover data. It was found that the image classification of the aerial photography would significantly improve the GAP classifications both with regard to boundary resolution and temporal accuracy. However, the analysis of natural color imagery is not without issues. The image classification process uses digital natural color imagery. Signatures or groupings within the electromagnetic spectrum are used to help identify or classify ground features such as urban, cropland, water, forests. There are 2 primary types of classification, unsupervised and supervised. An unsupervised classification allows the computer to automatically group

reflectance values into classes where supervised classification allows the analyst to select the bands of interest for each class.

There are many complications with the two different classification techniques. If you are using several images, each image must be treated separately as reflectance varies with time of day, season of the year, etc. Thus, classification rules vary from image to image. Often classification results are uncertain and/or inaccurate. Refining spectral values is as much an art as it is science-based methodology. Land use classes are rarely discrete with clearly defined boundaries. Often an edge pixel will contain several classes or transition areas between classes. In spite of this, the classification process assigns a single class to every pixel, ignoring uncertainty.

The classification of natural color imagery is also problematic as the spectral signatures do not clearly identify specific feature types. Often very different features have similar or identical reflectance signatures. This problem can be overcome, in certain circumstances, by using different types of imagery. For example, color infra-red imagery would be very helpful in extracting vegetation classes. For this project various supervised and unsupervised methods were experiment with all supplying varied results across the study area. In certain locations landscape features were identified cleanly where in other areas the features were not well identified. It was determined that the unsupervised classification method would be implemented on Jackson County in order to determine potential success, failures and costs of this method for the entire study area.

Jackson County is covered by 4 full "Level C" images and 8 partial images. Sixteen unsupervised classes were developed for each of these images. The first 3 to 4 classes which represented the darkest areas within image were used to roughly identify the forested areas. Each image was assessed to determine if any single or any combination of classes would represent a specific landscape feature.

A smoothing technique was used prior to classification to remove some of the smaller features. This process incorporated the minor feature into larger adjacent features through a neighborhood pixel averaging process. In most cases this process removed many of the random and difficult to classify pixels that would break up the landscape feature boundaries unnecessarily.

In general, forests and wooded areas are darker than most other landscape features. The nature of the forest features was very heterogeneous, varying according to age, density, slope and time of day. With the exception of water and some dark, freshly tilled soils, most of the darker regions within Jackson County were in forest or woodland. As described above the darker signatures also suggest water and dark soils. We were not able to spectrally tease these different features apart, which required a step of manual inspection and digitizing of edits to the forest layer. This manual visualization and editing process was very time consuming. To begin the process, classified spectral classes that best represented the forest communities were combined to form a single class. This class was then converted to a polygon vector file that represented the outlines of forest boundaries. Transparent shading was assigned to the forested polygons and layered over the 1 meter aerial imagery. On top of this a 5,000 meter grid was laid over the imagery and the forest polygons were edited. Forested polygons in each grid were reviewed checking for omissions and commissions. Heads up digitizing was used to add omitted forest lands and non-forested lands were removed from the forest polygons. Edits were primarily used to clean up edges and to incorporate forested island polygons. Wooded field edges and wooded rural residential areas were captured as well. Many of these problem

features were edited and refined while others still need more attention. Many of the polygons required the editor to make an interpretation of forest edge. Because many of the forest edges are not discrete, judgments are required slowing down the editing process.

During the initial review of the classification a variety of errors were found. In urban residential areas shadows represented a combination of trees and some shadows from buildings. The urban residential areas with more trees were classified as urban-residential with trees. This is not a perfect classification but it does identify residential areas with relatively more trees. This data layer was ultimately included in the Crosswalk Classification and improved the identification of forested areas in Jackson County significantly.



Figure 7. Various textures are found within the Jackson County forest cover boundary representing various forest types and various forest ages. Some recent clear-cut areas as well as some early succession forests are shown here. The overall the accuracy of the Jackson County forest boundary is much greater than any of the low-resolution land cover sources.

Data Sets and Classification Methods

The Crosswalk Classification throughout the project was a natural progression of give and take between data availability, the technical issues within the GIS and an end product that satisfied resource planners and their ultimate purpose for the data. Keeping this in mind three versions of the crosswalk classification are present within the final GIS land cover data layer named: "nri_allcnties" (these three classifications are found within the attribute table of the GIS shapefile). The three classifications are simple modifications of what AES and MARC has decided on as a final classification applicable for the purpose of this project called, "CROSS_URBF". The "CROSS_URBF" is used in this project because it is the generalization of the more detailed, but less accurate "FINAL_CLAS" but also includes urban forests unlike the classification attribute column "CROSS_NOUR". In summary, the three attribute columns found in the final natural resource inventory shapefile are as follows:

FINAL_CLAS: This classification is the most detailed but also has the greatest chance for error.

CROSS_URBF: This classification is deemed AES and MARC's most applicable for the nri because it generalizes information to a point of maximum accuracy while maintaining pieces of detail by identifying forested areas within the developed class.

CROSS_NOUR: This classification is the same as CROSS_URBF however the urban forests within the developed land class have been removed.

All discussion in this report refers to the classification CROSS_URBF or the "Crosswalk Classification"

The GIS methods used in the NRI classification of Johnson and Jackson counties are different from those used in the other counties. The process defined below is primarily a binary coding process. The methods used in defining developed land for all counties and forest cover for Johnson and Jackson counties are described above. All work was done on a county by county basis and files were merged once the county files had been completed.

The following datasets were unioned for Jackson and Johnson counties:

- (1) Developed land/undeveloped land,
- (2) Forested/non-forested cover,
- (3) GAP data,
- (4) Hydric soils (from SSURGO data), and
- (5) Aspects.

A dominance and priority rules were established for the classification (order of priority 1 being the highest):

1. Developed Lands (over rides all except in the case of the urban forest class)
2. NWI's open water
3. Hydric soils or NWI (not open water) (either Lowland Hardwood Forest, or Marsh and Wet Herbaceous)
4. Forested boundaries
5. Aspect
6. Soil Origin

All land was initially classified as either "developed" or "undeveloped." All developed land was labeled as "developed" except in Johnson and Jackson Counties where forest cover boundaries and developed areas coincided. These areas were classified as "**Urban Forest**".

"Developed Land": Parcels less than or equal to 10 acres and all parcels greater than 10 acres that were specifically defined as commercial or industrial (Described above).

"Undeveloped" land was further classified. If an undeveloped polygon was classified as "Non-Forested" then:

"Hydric soils" or NWI's (that were not open water) were classified "**Marshland and Herbaceous Vegetation**"

Non-hydric soils or non-NWI (that were not open water), polygons were classified as non-forested GAP crosswalk class: "**Grassland**", "**Cultural Grassland**", or "**Cultivated Land**". One exception to this rule was "Agricultural Land"

“Agricultural Land”: Non-forested, non-hydric soils that were GAP “Forested types”, that were made up of parcels coded as agricultural.

If an “undeveloped” polygon was classified as “Forested” then:

Where the “forested” polygons were coincidental with “hydric soils” or NWI (that were not open water) they were classified as **“Lowland Hardwood Forest & Woodland”**.

2. Where “forested” polygons were coincidental with “non-hydric” soils the polygons were further classified.

- a. “Forested”, non-hydric soils with north aspects were classified as **“Deciduous Forest”**.
- b. “Forested”, non-hydric soils with south aspects were further classified by soil origins.

Soils from forest origins were classified as **“Deciduous Woodland and Immature Forest”**.

Soils are thin-to-bedrock were classified as **“Mixed Evergreen Deciduous”**.

Soils from Grassland Origin were classified as **“Grassland”**.

Open water from NWI’s was classified as **“Open Water”**

Final classification assignments were coded and are found in the field “CROSS_URBF” of the data layer: “nri_allcnties”.

7.1. Reduction of File Size and Complexity of GIS Files

The polygon count was extremely high from the intersections and unions required in the development of this map. The dissolve function was initially used to merge adjacent polygons with the same classification. Because the file size and the number of polygons were so large the process failed. Instead the polygon file was converted into a 10 meter grid and grid cells were assigned values based on the polygon classes. Grid data was then converted back to a polygon format. Any reduction in accuracy or resolution is negated by the low resolution of the original data.

7.2. Classification Scheme for All Other Counties.

Classification of developed and undeveloped areas (as described earlier).

Undeveloped lands were unioned with GAP land cover data generating a land cover map for the undeveloped areas. GAP classes were re-assigned more generic land cover classifications according to the Applied Ecological Services (AES) Crosswalk Classification. This classification is thoroughly discussed above and in the associated technical report.

NWI sites were unioned with both developed and undeveloped areas. NWI classifications were reassigned according to the crosswalk classification. NWI sites were assumed to be most accurate data layer and thus override all earlier classifications.

Final classification assignments were coded and are found in the field “Cross_nour” of the data layer: “nri_allcnties”.

A few significant errors were found in the NWI data. Changes were made in the final NRI coverage and not in the source NWI files. Of particular interest was a large wetland lake area in

southeast Cass County. The lake does not show up on any of the other data sets. We do not have the aerial photography to verify this error. In this area the GAP classifications were reassigned to the area. Other smaller changes were made to the final NRI based on field work.

7.3. NRI Grid Map Option

A grid version of the NRI GIS map was generated with a 10 meter pixel resolution. The map does not replace the vector map but was developed and used strictly for presentation purposes.

8. Hard Drive and Metadata

The GIS metadata for this project is provided in Appendix A-2, as well as on a hard drive submitted to MARC. This is the first version of the GIS data. The hard drive includes all data that was collected and developed during phase 1 and 2 of the Kansas City Natural Resource project.

The data is divided into 2 primary types, qualified and unqualified data. Qualified data is directly related to the deliverable products such as the NRI map. All deliverable product GIS files will include metadata linked to their associated shapefiles. Other supportive data such as US Census Tiger files will include metadata from their original source. These metadata are not linked to shapefiles. An abbreviated metadata addendum will be provided describing any alteration, extraction or manipulation of the data. NRI metadata will be provided for both the NRI composite file as well as the individual county NRI files.

Unqualified data is secondary data that (1) was used in the development process (intermediate files) or (2) remains unrelated to the final products but was collected during phase 1 and 2. Original source metadata will be included when it is available. No additional metadata description or discussion will be provided in the metadata folder other than the source metadata. Examples of unqualified data are US ACOE data that may be useful to MARC, but had no direct application to the deliverable products. Some unqualified data sets may have no metadata. These data can ultimately be culled from the hard drive if they provide no value to MARC.

Developing the metadata is not a trivial process and is very time consuming. We have included an example of the linked metadata in the Cass County NRI section found at:
U:\GIS_data\Qualified_Data\ShapeFiles\01AES_data\NRI_Class\County_nri_shape\Cass_NRI

We are including a meta-metadata ACCESS database that lists all files found in the hard drive, their file type and location on the hard drive. Please refer to: (U:\Meta_metadata). A set of queries have been set up to help you better understand and investigate the hard drive contents. These queries identify and list key file types. Description and Use Ranking fields describe the primary aspects of the data and its use in phase 1 and 2 (see below for descriptions of all ACCESS database fields). Of course there are 100s of thousands of files and many gigabytes of data so the descriptions focus on the primary data types (for example SHP files are described and SHX files are not within the qualified data folder). Additional meta-metadata have been added in EXCEL format. This includes a spreadsheet identifying all primary data types and sources. A second spreadsheet includes a more detailed description of the various data that was targeted and/or collected for this project. These files should be very helpful to your GIS analyst.

Final delivery map projects (.mxd) and exploratory data projects are provided in two folders depending upon whether the project was a deliverable or used throughout the project process

(for example PowerPoint presentation graphics). If the mxd was used as a deliverable for example the NRI Land Cover Map the mxd will be at:

U:\GIS_data\Qualified_Data\mxd_apr

These mxd's have been linked to the hard drive and should open without having to reestablish directory links. It will be imperative to maintain the same file structure and drive labels for these projects to work properly. If a project file has simply been used as a process map or used to generate communication graphics it will be found at:

U:\GIS_data\UnQualified_Data\mxd_apr

These files are not directly associated to the hard drive file format however may easily be linked to associated data set within the hard drive. This is an easy process however quite time consuming and remains outside the scope of this project. These files have been provided to MARC however can be culled out and deleted if MARC does not find them valuable. All of the graphics create for communication to this point has been provided as PowerPoint presentations and .PDF files.

We have included an extensions folder and all of the non-proprietary ARCGIS extensions that we used in the project. The watershed extension for example is of particular value. Installation and backup of this first hard drive is not imperative at this time. You can work with the data simply by plugging the hard drive into one of your USB ports. If you have any trouble please contact your computer systems analyst (USB drivers are provided on the CD if necessary). Assign the drive letter of "U" to the external hard drive. Please review the data organization, projects and metadata (meta-metadata) examples.

As stated above this hard drive is a first version of the data and will be updated prior to the training session in the near future. There is an enormous amount of data on this hard drive. Some of the less useful or experimental data may be deleted from the second version.

Table 1. ACCESS database file headings and their description

ACCESS FILE HEADING	DESCRIPTION OF HEADING
ID	Number give to each file
PATH	Path in which file may be found
Description	Description of what the file is
FILENAME	Name of file
FILEEXT	Extension of file
FILETYPE	Type of File
SIZE_MB	Size of file in Megabytes
DATE	Date file was created
TIME	Time file was created
DATETIME	Date and time file was created
D1	1 st description of file path
D2	2 nd description of file path
D3	3 rd description of file path
D4	4 th description of file path
D5	5 th description of file path
D6	6 th description of file path
D7	7 th description of file path
D8	8 th description of file path
D9	9 th description of file path
D10	10 th description of file path
D11	11 th description of file path
Usefulness Rating	Rating 1-3: 3 most useful to NRI, 1 lest useful to NRI
Used in NRI	YES OR NO whether data was used to generate NRI land cover
Data Extent	Geographic extent of data
Meta Data	Is there meta data for file
Constraints	Is there a signed data sharing agreement associated with data

Appendix A-2: Natural Resource Inventory (NRI) Metadata

Metadata also available as

Metadata:

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

Identification_Information:

Citation:

Citation_Information:

Originator: (MARC) Mid-America Regional Council

Originator: (AES) Applied Ecological Services

Publication_Date: June 2004

Title: Natural Resource Inventory (NRI)

Edition: Version 1

Geospatial_Data_Presentation_Form: vector digital data

Online_Linkage: Not available on-line

Description:

Abstract:

The Natural Resource Inventory (NRI) for MARC study area is a composite of 8 county NRI GIS maps. The development of this natural resource inventory is a critical first step toward solid environmental planning for watershed management, resource conservation, and restoration at the county level.

In the 3000 square mile Kansas City Metropolitan Area there is a strong unmet need for a coherent natural resource inventory. The region's many streams are threatened by significant land use change, yet flow across multiple jurisdictional boundaries that prevent unified action. Changes in regional land use are widespread and need to be understood so that the challenge of habitat fragmentation and habitat degradation can be addressed. Finally, an integrated view of the distribution, extent and ecological health of the region's natural resources is fundamental to developing watershed-based policies that maintain the character and function of these resources. One of the major products of this initiative is a regional map depicting ecological land cover and oriented towards natural resource conservation. This map and the fieldwork it incorporates represent a natural resource inventory across a broad region.

This project will result in several other outcomes. With this project the Mid-America Regional Council (MARC) will implement the region's first multi-phase, collaborative, community-based initiative to document, map, and ultimately conserve natural resources within the Kansas City Metropolitan Area. The development of a natural resources

inventory is a critical first step toward solid environmental planning at the local level, and a systems-based framework for watershed management, resource conservation, and restoration at the regional level.

These other projects have benefited air and water quality, flood damage reduction efforts, critical ecosystem and biodiversity conservation, habitat and wildlife conservation, stream course stabilization efforts, the creation of neighborhood and development amenities, human health (by providing opportunities for fitness and outdoor recreation), and attempts to create sustainable urban development patterns.

This project builds on past inventory and conservation work for critical ecosystems and valuable natural resources in the region. It will result in an up-to-date assessment of the condition of ecosystems and natural resources; compile consistent baseline information in a usable GIS format for use in local planning processes (e.g., watershed plans, greenway plans); support the identification and implementation of high priority MetroGreen trail segments around the region; and offer opportunities to educate Kansas City audiences about the value of local natural resources and the value of sound environmental planning and stewardship.

Purpose:

The purpose for the NRI is to support a variety of natural resource activities related to water quality, flood mitigation, critical ecosystem and biodiversity conservation, habitat and wildlife conservation, stream course stability, creation of neighborhood and development amenities, improved human health with increased opportunities for fitness and outdoor recreation, and more sustainable urban development patterns.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1971

Ending_Date: 2003

Currentness_Reference: ground condition

Status:

Progress: Complete

Maintenance_and_Update_Frequency: None planned

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -95.203828

East_Bounding_Coordinate: -93.746547

North_Bounding_Coordinate: 39.550778

South_Bounding_Coordinate: 38.431178

Keywords:

Theme:

Theme_Keyword_Thesaurus: NRI

Theme_Keyword: Natural Resource Inventory

Theme_Keyword: NRI

Place:

Place_Keyword: Kansas

Place_Keyword: Missouri

Place_Keyword: Cass County, MO

Place_Keyword: Clay County, MO

Place_Keyword: Jackson County, MO

Place_Keyword: Platte County, MO

Place_Keyword: Ray County, MO

Place_Keyword: Johnson County, KS

Place_Keyword: Leavenworth County, KS

Place_Keyword: Wyandotte County, KS

Temporal:

Temporal_Keyword: 1971

Temporal_Keyword: 2003

Access_Constraints:

Data is available through Mid-America Regional Council (MARC). For more information about data distribution please call Steve Gay at (816) 474-4240 Ext.493 or stop by the offices located at 600 Broadway, Suite 300, in downtown Kansas City, Missouri, 64105

Use_Constraints:

MARC NRI data is a composite of several datasets with different

Time_Period_of_Content values and different data resolutions. Use this data for applications requiring map scales of 1:100,000 or smaller.

GAP data Time_Period_of_Content is current as of 1991. A more recent land use and land cover map would be very helpful.

NWI Data Time_Period_of_Content ranges in from Feb. 1971 to Nov. 1997.

Cadastral data Time_Period_of_Content is current to 2003. Cadastral data was used to help identify urban and non-agricultural areas.

Point_of_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Mid-America Regional Council

Contact_Person: Steve Gay

Contact_Position: GIS Manager

Contact_Address:

Address_Type: mailing and physical address

Address: 600 Broadway Suite 300

City: Kansas City

State_or_Province: MO

Postal_Code: 64105

Contact_Voice_Telephone: 816/474-4240 Ext.493

Contact_Electronic_Mail_Address: sgay@marc.org

Browse_Graphic:

Native_Data_Set_Environment:

Microsoft Windows 2000 Version 5.0 (Build 2195) Service Pack 4; ESRI ArcCatalog 8.3.0.800

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

First Field Reconnaissance

The goal of field reconnaissance was to obtain information for revising the ecological land cover classification and resulting mapping, evaluate the condition of selected natural resources, and develop an understanding of the conservation needs in the Kansas City Metropolitan Area. The first field reconnaissance was performed in Jackson County, with the intent of extrapolating the findings to the rest of the region. The intent of field reconnaissance was to visit locations that represented the entire county and region, as well as to locate significant and rare natural resources, such as remnant prairies and undisturbed forests. The results of the field reconnaissance were used to create an initial ecological land cover classification and natural resources inventory for the region.

Field Visits

The first field reconnaissance was completed September 15-18, 2003. Five AES staff and one employee of Patti Banks and Associates formed two teams and visited over 150 locations in Jackson County. The following data were obtained at locations that were used as references for revising the ecological land cover classification:

- County
- Site Number
- AES Type 1
- AES Type 2
- Canopy Dominants (trees collectively comprising 90% of highest vegetation layer)
- Subcanopy Dominants (trees/shrubs collectively comprising 90% of layer below canopy)
- Groundlayer Dominants (trees/shrubs/herbs collectively comprising 90% of <1m vegetation)
- Other Species (common species, species that indicate diversity of site, rare species, etc.)
- Condition Rank (see Table 2)

- Notes (remarks that further describe the site)
- Soil Series (from soils map)
- Kansas/Missouri GAP Type (from GAP land cover map)
- Stewardship Problems (invasive species, fire suppression, over-grazing, erosion, etc.)

Locations of visited sites were digitized and the field information entered into a database.

Prior to visiting sites in the field, field maps were prepared. Separate maps showed AES Type 2 ecological land cover, GAP land cover, and soils data on a base of streams, roads, municipal boundaries, and contours. These maps initially were produced on paper at 1:4,000 scale. In the second field reconnaissance, all data were placed in digital form on laptops carried in the field. Digital information could be displayed on ortho-photographs, and field staff selected sites and navigated using this information. When visiting a site, staff digitized its location and entered data in the database linked to that digital location. Other data were written on field for later data entry in the office.

At each site in Jackson County the GAP type was checked and the edge of the GAP polygon was examined relative to the aerial photographs. This provided a further understanding of the limitations of the GAP classification and the changes necessary to improve its quality.

The greatest challenge in field reconnaissance was to correlate the field information on ecological conditions of natural resources to the aerial photography available for the

region. To accomplish this, ecological conditions were ranked at many locations using a pre-determined ranking system (Table 2). Aerial photography was then examined to determine if the ecological conditions seen in the field were readily apparent on the aerial photography.

Table 2. Ecological Condition Ranks (letters may be combined to suggest a range of conditions) A Excellent: The plant community is intact and fully functional. Its soils, vegetation structure, plant diversity, and ecosystem functions have not changed substantially for decades, if not centuries. B Good: The plant community is intact and functional, but soils, vegetation structure and plant diversity were slightly modified by land use in the past century or more. C Fair: The plant community is damaged and has lost species and ecosystem functions as a result of incompatible land use in the past century or more. Its vegetation structure can be quite different from that existing in the plant community over a century ago. D Poor: The plant community is highly damaged by long-term incompatible land use, but is still recognizable as a plant community of the type. Soils are usually intact, but vegetation structure has changed greatly, and many species have been lost and replaced by non-native invasive species. NR Not Ranked. The location is culturally created (e.g., residences, cropland, orchard, pasture, impoundment).

The general conclusion was that the condition of natural resources in the field was not readily apparent on aerial photography, except for the more mature forests and remnant prairies. The more mature forests were in general classified as forests in GAP, while less mature forests were classified by GAP as woodlands. It was also determined, using soils information, that most of the GAP woodlands in the Kansas City Metropolitan Area have developed where prairie grew 150 years ago. As such, they represent forests of poorer ecological conditions compared to forests which have existed at the same location for several thousand years, as is the case for the more mature forests of the region. The soils on which such forests grew were generally hapludalfs, or soils that are transitional between typical grassland and typical forest soils. It was also found that some GAP forests located on these soils were recovering from severe cutting decades ago. These forest contained large honey-locust (*Gleditsia tricanthos*), an indicator of disturbance, rather than large oak (*Quercus*) trees encountered in the more mature forests on forest soils of the region. A predominance of oak in a forest of the Kansas City region indicates better ecological conditions.

Remnant prairies were also evident on the aerial photography by the color and the texture of the photograph. The GAP classification and inventory work did not accurately locate remnant prairies. Remnant prairies visited during AES field reconnaissance were already known through previous inventories or were discovered by AES staff. While AES staff could identify potential remnant prairies from their color-texture signature, it was not feasible given the project budget to locate and visit all remnant prairies in the Kansas City Metropolitan Area.

Second Field Reconnaissance

Two AES teams assembled in Kansas City during the period November 18-21, 2004 to complete the second field reconnaissance. Staff sought to represent all habitats, slopes, aspects, and geographical locations in the Kansas City region for those natural communities where classification questions remained. In addition, AES searched for natural communities in good ecological condition. AES planned to add these better condition natural communities to the reference sites already assembled from previous inventories in order to, at a later time, identify conservation hotspots in the Kansas City region.

AES teams checked over 150 locations outside Jackson County. AES digitized these locations and entered field data in the spatial database. These field data were combined with previous field data, Heritage program field data, and Natural Resources Inventory data collected by others. These digitized field data establish a set of reference stands to aid future classification and inventory work, and help to establish conservation priorities in the Kansas City region.

Results from the second field reconnaissance were used to refine the initial ecological land cover (ELC) classification (Table 4). The natural resources of the 8-county Kansas City region were mapped using the ELC classification

Accuracy Issue in Spatial data in Jackson and Johnson Counties are more recent and accurate than the other six counties. This is due to the special procedures used to refine the existing GAP data. The method provided great detail and accuracy, but requires additional resources. For example, the unsupervised forest classification followed by hand-editing in Jackson County required approximately 40 hours of labor. The high labor requirement made this method too costly to employ in the other counties, but provided a model that could be followed in other counties.

As mentioned above, rare communities-prairies, limestone glades, oak savannas-were not accurately identified in existing GAP inventories, and while AES staff located remnants of these communities, by no means were all remnants identified. In

Using parcel (cadastral) data helped to improve the accuracy of the spatial data, but may also have introduced errors into the data in rural lands. This is because the small parcel criteria AES used (<5 acres) to identify potentially developed lands may also have included small undeveloped tracts used as recreation land. These parcels, nevertheless, have a greater potential to be developed in the future because they have been subdivided from larger agricultural ownership blocks.

Due to the lack of detailed work in counties outside Jackson and Johnson, the information must be interpreted with care. For example, in Leavenworth County it appears that there are many locations of "Grassland." As defined in the ecological land use classification and used in the natural resource inventory work for this project, "Grassland" is a nearly treeless expanse that likely contains native plant species, and may also include

Conservation Reserve Program lands. However, in Leavenworth County these areas are not pristine prairies, and in many cases may have been significantly altered by over-seeding with the non-native tall fescue, and herbiciding to kill broad-leaved prairie plants. Nevertheless, these locations have a greater chance of containing warm-season prairie grasses and native prairie plants than those locations which the GAP classification identified as "Cultural Grassland." Therefore "Grassland" is used despite the potential for inaccuracy. As already mentioned, identifying all the remnant native prairies in the Kansas City region would require special inventory work outside the scope of this project.

Some data gathered for use in Jackson County stream and watershed assessment work were not used in the development of the ELC classification. These data include floodplain boundaries, stream stability models, and stream buffers. These data will be used in future work to establish conservation priorities in the Kansas City region.

AES employed its field data and that of the Kansas and Missouri Heritage Programs and Biological Surveys in order to test the accuracy with which the classification and inventory could predict ground conditions. These field data represent a small fraction of the surface area of the Kansas City region, and therefore provide only a sample of what can be expected from the classification and inventory work when it is used throughout the region.

In general, deciduous forest and woodland data most accurately predict conditions on the ground. AES estimates that in Jackson and Johnson County, the classification and natural resources inventory is greater 90% accurate in correctly identifying land as forested or wooded, and in correctly representing the boundary of those forests. In the other counties, because GAP was used, the accuracy of the boundary is greatly reduced, and the accuracy of the identity of a forest patch was less than 90%.

The classification and inventory are less accurate in predicting Lowland Hardwood Forest and Woodland in Jackson and Johnson County, and lower still in the other counties. This lower performance is due to the fact that the trees which comprise lowland hardwood forest are also capable of invading upland draws and ravines throughout the region. Therefore sites which might be classified as deciduous woodland/immature forest can appear to be lowland hardwood forest and woodland; often these sites were prairie or savanna prior to 1850. In addition, in many locations intentional damming of stream segments saturates upland soils, creating lowland hardwood forest where upland forest existed previously.

As already discussed, detecting prairies, limestone glades, and oak savannas in good condition will require additional detailed inventory work outside this project's scope. This classification and inventory will not predict the existing of good examples of these communities with great certainty, perhaps with an accuracy of less than 10%. However, in Jackson and Johnson Counties, the classification and inventory data identified thin-soil areas and southern forested slopes which have the greatest potential to support these

communities. Good examples of these communities could be located with additional inventory work using the concepts inherent in the classification and inventory.

The classification and inventory predict wetland occurrence in the field with a fair degree of accuracy due to the use of National Wetland Inventory mapping. However, these data are at least a decade or more old. The classification does not match wetland boundaries to field conditions as well as it identifies the existence of a wetland.

Logical_Consistency_Report: No report

Completeness_Report: No report

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Vertical_Positional_Accuracy:

Lineage:

Source_Information:

Source_Citation:

Citation_Information:

Originator: Missouri Resource Assessment Partnership (MoRAP)

Publication_Date: 1999

Title: Missouri GAP Data

Other_Citation_Details:

James D. Harlan Geographic Resources Center Assistant Program Director

Contact_Address: *Address_Type:* mailing address *Address:* #16 Stewart Hall City:

University of Missouri-Columbia *State_or_Province:* Missouri *Postal_Code:* 65211

Country: USA *Contact_Voice_Telephone:* (573) 882-1404

Contact_Electronic_Mail_Address: harlanj@missouri.edu

Online_Linkage: <<http://msdisweb.missouri.edu/data/lulc/>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: Kansas Applied Remote Sensing (KARS) Program

Publication_Date: 2001-03-04

Title: Kansas GAP Data

Other_Citation_Details:

Contact_Organization: Kansas Applied Remote Sensing (KARS) Program

Contact_Person: Stephen Egbert *Contact_Position:* Project Manager *Contact_Address:*

Address_Type: mailing address *Address:* 2335 Irving Hill Road City: Lawrence

State_or_Province: Kansas *Postal_Code:* 66045-7612 *Country:* USA

Contact_Voice_Telephone: (785) 864-7720 *Contact_Facsimile_Telephone:* (785) 864-

0392 *Contact_Electronic_Mail_Address:* s-egbert@ukans.edu

Online_Linkage: <<http://mercury.ornl.gov/nbii/referral.jsp?refer=5>>

Online_Linkage:

<http://www.kars.ku.edu/research/current_research/gap.shtml#contact>

Source_Scale_Denominator: from 1;24,000 to 1:100,000

Type_of_Source_Media: raster

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1995

Ending_Date: 2000

Source_Information:

Source_Citation:

Citation_Information:

Originator: USFWS

Publication_Date: varies

Title: National Wetland Inventory

Online_Linkage: <<http://www.nwi.fws.gov/downloads.htm>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: US Census Bureau

Publication_Date: 2002

Title: TIGER Line Files

Online_Linkage: <<http://www.census.gov/geo/www/tiger/tiger2002/tgr2002.html>>

Online_Linkage: <<http://www.census.gov/geo/www/tiger/tiger2002/tl2002meta.txt>>

Source_Information:

Source_Citation:

Citation_Information:

Originator:

Obtained through Mid America Regional Council for specific counties

Publication_Date: 2003

Title: Cadastral Data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2003

Source_Information:

Source_Citation:

Citation_Information:

Originator: U.S. Geological Survey (USGS), EROS Data Center

Publication_Date: 1999

Title: National Elevation Dataset (NED)

Other_Citation_Details:

Publication_Information: Publication_Place: Sioux Falls, SD Publisher: U.S. Geological Survey

Online_Linkage: <<http://gisddata.usgs.net/ned/>>

Source_Scale_Denominator: 1:24000

Type_of_Source_Media: raster digital data

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 1999

Source_Citation_Abbreviation: NED

Source_Information:

Source_Citation:

Citation_Information:

Originator: Mid-America Regional Council

Publication_Date: 2003

Title: 911 Road Centerline Data

Other_Citation_Details:

Mid-America Regional Council 600 Broadway, Suite 300 Kansas City, MO 64105
816/474-4240 Fax 816/421-7758

Online_Linkage: <<http://www.marc.org/>>

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2003

Source_Information:

Source_Citation:

Citation_Information:

Originator:

U.S. Geological Survey in cooperation with U.S. Environmental Protection Agency

Publication_Date: 1999

Title: National Hydrography Dataset (NHD)

Other_Citation_Details:

Publication Place: Reston, Virginia Publisher: U.S. Geological Survey

Online_Linkage: <<http://nhd.usgs.gov/data.html>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: U.S. Geological Survey (USGS)

Publication_Date: 2000-05-07

Title: NLCD- National Land Cover Data Set (Kansas and Missouri)

Edition: 1

Other_Citation_Details:

Geospatial_Data_Presentation_Form: raster digital data Publication_Place: Sioux Falls, SD USA Publisher: U.S. Geological Survey

Online_Linkage: <<http://edcwww.cr.usgs.gov/programs/lccp/natl/landcover.html>>

Source_Information:

Source_Citation:

Citation_Information:

Originator: Applied Ecological Services

Publication_Date: 2003

Title: Field Data

Online_Linkage: none

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2003

Source_Information:

Source_Citation:

Citation_Information:

Originator: AerialsExpress

Publication_Date: 2001

Title: Aerial Imagery 2001

Other_Citation_Details:

Source: Aerials-Express Contact Info: AerialsExpress, Email info@AerialsExpress.com

Telephone 1-888-482-2336 <<http://www.aerialsexpress.com/main2.php3>> State: MO/KS

Area: Kansas City Resolution: 1 meter Data: 2001-11 Sq Miles: 3639 Type: Natural

Color Photography Coordinate System: UTM-15

Online_Linkage: <<http://www.aerialsexpress.com/main2.php3>>

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2001

Source_Information:

Source_Citation:

Citation_Information:

Title: SSURGO Soils

Online_Linkage:

<http://www.ncgc.nrcs.usda.gov/branch/ssb/products/ssurgo/index.html>

Online_Linkage:

<http://www.ncgc.nrcs.usda.gov/branch/ssb/products/ssurgo/fact-sheet.html>

Online_Linkage: <http://soildatamart.nrcs.usda.gov/State.aspx>

Online_Linkage:

<http://soildatamart.nrcs.usda.gov/documents/SoilDataMartMetadataTables.pdf>

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: varies

Process_Step:

Process_Description:

Digital NRI for the 8 county study area were generated. County files were prepared and merged together. Each county file was reference from it source file by a combine county abbreviation and file record number. Attribute data from each file was collected in a linked ACCESS table. Small manipulations were made in the Access database to accomodate the various requests of the AES ecologic review team. Final classifications were assigned.

The following notes generally address the classification process and issues. "Developed" or "Undeveloped" classification 1. Cadastral (parcel size) was used to identify developed and undeveloped land in Cass and Clay counties. Parcels less than or equal to 10 acres are defined as "urban area" by NRCS. Parcels greater than 10 acres are considered undeveloped unless use or tax codes show otherwise. 2. Cadastral (use codes and/or tax codes were used defining agricultural, exempt, residential, other-developed or undeveloped) were used to identify developed and undeveloped land in Cass and Johnson counties. 3. Parcel "use codes" are the most accurate method for the identification of developed and undeveloped land. Smaller parcels that are identified as residential, commercial, industrial, etc are easily classified as "developed." Larger parcels with these classifications are more suspect as a single larger parcel may support more than 1 land use. Most tax offices report only the primary use of the land for tax purposes. For example, an industrial property may use 10 acres of a 100 acre parcel very intensively while the remaining 90 acres is temporarily left undeveloped. However, a ¼ acre lot with a building is, without a doubt, intensively developed. 4. If use codes are not available "parcel size" is still a very accurate method of defining developed and undeveloped land. Parcel size directly expresses the intensity of land use for a parcel. NRCS defines parcels of 10 acres or less as "urban area." 5. Because parcel information is developed and maintained for tax assessment purposes the information is highly resolved, use data is accurate and the data is updated annually. Thus change in "urban area" can be tracked accurately annually. 6. The "roadless polygon method" to classify developed and

undeveloped land is less accurate than parcel data, however it is adequate for small scale mapping such as the development of the NRI maps. Roadless areas strongly suggest the intensity of land use within the roadless polygon. However the resolution of roadless areas is less precise cadastral methods. Also variables such as changes in road width do suggest changes in land use intensity, these changes are not often recorded in road data or easily quantified in the roadless polygon metrics. Road data may vary in its quality and reporting period between administrative areas. · Roadless area polygons are bounded by roads and railroads generated from road and railroad GIS line data. Smaller roadless areas imply more intensively utilized land. Small parcel size (where cadastral data is available) also implies more intensive land use. One variation to this metric that incorporates dead end roads into the metric is to summarize "grid distance from roads" by roadless polygon. · Methods used to classify land as "developed" or "undeveloped" by county. i. Cadastral: Use Codes and Parcel Size (Cass) ii. Cadastral: Parcel Size (Clay, Johnson) iii. Roadless Polygon: (Jackson, Platte, Ray, Leavenworth, Wyandotte)

High Resolution Forest Cover 1. In Jackson and Johnson County we have accurate forested themes. This data was generated from the aerial photo interpretation process in Jackson County. 2. Forest cover data was provided by Johnson County GIS department for their county. 3. AES provided a more detailed analysis for forested lands based on hydric and soil origin characteristics, aspect (north/south). Gap data was used to help define non-forested undeveloped areas. This classification is refined by GAP data where appropriate or considered unclassified. This non-forested, undeveloped class is one of the least reliable classes based on conflicts within the source information. 4. Where cadastral information was not available roadless polygons were used to identify developed and undeveloped lands in Jackson, Platte, Ray, Leavenworth, Wyandotte. Many tests were done to identify developed from undeveloped lands. Visual interpretations from aerial photos were used in this process.

Forest Cover In Johnson and Jackson Counties

1. Forested area was derived from aerial photo interpretation via remote sensing methods in Jackson County. 2. Johnson County forested lands of similar quality were provided by Johnson County. In either case these boundaries represent the most highest resolved and most recent data used in the NRI mapping project. 3. Further refinements in the forested classification were made using GAP, Hydric Soils, Aspect, and Soil Origin data. 4. Urban Woodlands in Jackson County: Urban Forests are areas found within developed areas where aerial photo classification methods indicate forests. These urban forests are generally small in size and often capture areas of the city that are more wooded than others. In many cases these areas may represent a clustering of trees in residential areas and in some cases tree lines along property boundaries. The quality of these wooded areas may be very poor ecologically.

Non-Forested Assignments in Jackson and Johnson Counties "Forested" or "Unforested" classification The county was initially divided into "forested" and "non-forested lands." Forest cover was derived from aerial photo interpretation via remote sensing methods in

Jackson County. These forest boundaries represent the highest resolution and most recent data used in this classification process.

"Non-Forested" further classified Non-forested hydric soils were classified as "Marshland and Herbacious Vegetation" Non-forested and non-hydric were classified as "developed."

"Forested" further classified Forested areas that coincide with any of the GAP "non-forested" classifications the areas were classified as "Deciduous Woodland, Immature Forest." These same forested areas with hydric soils were classified as "Hydric Lowland Hardwood Forest & Woodland." These same forested areas with non-hydric soils were further classified. Those areas with north aspects were classified as "Deciduous Forest." Those areas with south aspects were further classified by soil origins. Areas with soils from forest origin were classified as "Deciduous Woodland and Immature Forest." Areas with soils that are thin-to-bedrock were classified as "Mixed Evergreen Deciduous." Areas with soils from Grassland Origin were classified as "Grassland."

"Urban Woodlands" discussion Urban Forests are areas found within developed areas where aerial photo classification methods indicate forests. These urban forests are generally small in size and often capture areas of the city that are more wooded than others. In many cases these areas may represent a clustering of trees in residential areas and in some cases tree lines along property boundaries. The quality of these wooded areas may be very poor ecologically.

Assignments of other counties. "Undeveloped" areas further classified. Undeveloped lands were unioned with GAP land cover data generating a land cover map of the undeveloped areas. GAP classes were re-assigned more generic land cover classifications according to the Applied Ecological Services Crossover assignments.

Hydric Soil refinements NWI sites were unioned with the entire county coverage. NWI classifications were reassigned according to more generic AES classifications. NWI sites were assumed to be most accurate data layer and thus overrode all earlier classifications.

Final assignments "Final_Clas."

Note: Reduction of file size and complexity. The polygon count was extremely high from all of the intersections and unions required in the development of this map. "Dissolve" was initially used to try and merge adjacent polygons with the same classification. Because the file size and the number of polygons was so large the process failed. Instead the polygon file was converted into a 10 meter grid and grid cells were assigned values based on the polygon classes. Grid data was then converted back to a polygon format. Any reduction in accuracy or resolution is negated by the lower resolution of the original data.

Process_Date: June 2003

Process_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Applied Ecological Services
Contact_Person: Jason Carlson/Neil Thomas
Contact_Position: GIS Analyst
Contact_Address:
Address_Type: mailing and physical address
Address: 17921 Smith Road, P. O. Box 256
City: Brodhead
State_or_Province: WI
Postal_Code: 53520
Contact_Voice_Telephone: 608.897.8641
Contact_Electronic_Mail_Address: jason@appliedeco.com
Process_Step:
Process_Description: Metadata imported.
Source_Used_Citation_Abbreviation:
C:\WINNT\Profiles\ADMINI~1\LOCALS~1\Temp\xml77.tmp
Process_Step:
Process_Description: Metadata imported.
Source_Used_Citation_Abbreviation:
C:\WINNT\Profiles\ADMINI~1\LOCALS~1\Temp\xml11C.tmp
Process_Step:
Process_Description: Metadata imported.
Source_Used_Citation_Abbreviation:
C:\WINNT\Profiles\ADMINI~1\LOCALS~1\Temp\xmlA9.tmp

Spatial_Data_Organization_Information:
Direct_Spatial_Reference_Method: Vector
Point_and_Vector_Object_Information:
SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type: G-polygon
Point_and_Vector_Object_Count: 588082

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Planar:
Grid_Coordinate_System:
Grid_Coordinate_System_Name: Universal Transverse Mercator
Universal_Transverse_Mercator:
UTM_Zone_Number: 15
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.999600
Longitude_of_Central_Meridian: -93.000000
Latitude_of_Projection_Origin: 0.000000
False_Easting: 500000.000000
False_Northing: 0.000000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abscissa_Resolution: 0.000256
Ordinate_Resolution: 0.000256
Planar_Distance_Units: meters
Geodetic_Model:

Horizontal_Datum_Name: North American Datum of 1983
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137.000000
Denominator_of_Flattening_Ratio: 298.257222

Entity_and_Attribute_Information:

Detailed_Description:

Entity_Type:

Entity_Type_Label: NRI

Attribute:

Attribute_Label: FID

Attribute_Definition: Internal feature number.

Attribute_Definition_Source: ESRI

Attribute_Domain_Values:

Unrepresentable_Domain:

Sequential unique whole numbers that are automatically generated.

Attribute:

Attribute_Label: Shape

Attribute_Definition: Feature geometry.

Attribute_Definition_Source: ESRI

Attribute_Domain_Values:

Unrepresentable_Domain: Coordinates defining the features.

Attribute:

Attribute_Label: CNTY

Attribute_Definition: County Name

Attribute_Definition_Source: US Census TIGER

Attribute:

Attribute_Label: RECORD

Attribute_Definition: Record Number from each contributing database

Attribute_Definition_Source: Applied Ecological Services

Attribute_Domain_Values:

Beginning_Date_of_Attribute_Values: 2003

Ending_Date_of_Attribute_Values: 2003

Attribute:

Attribute_Label: FINAL_CLAS

Attribute_Definition: First Classification includes most detail

Attribute_Definition_Source: Applied Ecological Services

Attribute_Domain_Values:

Enumerated_Domain:

Enumerated_Domain_Value: Agriculture

Enumerated_Domain_Value_Definition: Used as farmland (specific to Jackson and Johnson Counties)

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Cultivated Land

Enumerated_Domain_Value_Definition: Used as cropland

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Cultural Grassland

Enumerated_Domain_Value_Definition:

Grassland of planted domesticated grasses, or formerly cultivated land reverting to grassland and sometimes brush

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Deciduous Forest

Enumerated_Domain_Value_Definition:

Mostly closed canopy of deciduous trees, often mature; includes former savannas on south to west slopes

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Deciduous Forest (Urban)

Enumerated_Domain_Value_Definition:

Mostly closed canopy of deciduous trees, often mature; includes former savannas on south to west slopes (urban areas)

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Deciduous Woodland and Immature Forests

Enumerated_Domain_Value_Definition:

Open canopy of deciduous trees; often immature; may contain former savannas, or glades on soils with bedrock close to surface

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Deciduous Woodland and Immature Forests (Urban)

Enumerated_Domain_Value_Definition:

Open canopy of deciduous trees; often immature; may contain former savannas, or glades on soils with bedrock close to surface (urban)

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Developed Land

Enumerated_Domain_Value_Definition:

Urban and suburban land uses, including homes, businesses, roads

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Forested Wetland

Enumerated_Domain_Value_Definition: Wetlands with an NWI code for forests

Enumerated_Domain_Value_Definition_Source: USFWS NWI Coding

Enumerated_Domain:

Enumerated_Domain_Value: Forested Wetland (Urban)

Enumerated_Domain_Value_Definition: Wetlands with an NWI code for forests in an urban area

Enumerated_Domain_Value_Definition_Source: USFWS NWI and Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Grassland

Enumerated_Domain_Value_Definition:

Grassland, often containing native wild plants; may include CRP plantings

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Lowland Hardwood Forest and Woodland

Enumerated_Domain_Value_Definition: Open to closed forest canopy in flooded or wetland areas

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Lowland Hardwood Forest and Woodland (Hydric)
Enumerated_Domain_Value_Definition:
Open to closed forest canopy in flooded or wetland areas on hydric soils
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Lowland Hardwood Forest and Woodland (non-Hydric)
Enumerated_Domain_Value_Definition:
Open to closed forest canopy in flooded or wetland areas on non-hydric soils
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Lowland Hardwood Forest and Woodland (Urban)
Enumerated_Domain_Value_Definition:
Open to closed forest canopy in flooded or wetland areas in an urban area
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Marsh and Wet Herbaceous Vegetation
Enumerated_Domain_Value_Definition:
Wetlands without a closed forest canopy; includes brush and scattered trees
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Mixed Evergreen Deciduous
Enumerated_Domain_Value_Definition:
Open to mostly closed canopy of junipers and deciduous trees; often oaks; may include former savannas
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Mixed Evergreen Deciduous (Urban)
Enumerated_Domain_Value_Definition:
Open to mostly closed canopy of junipers and deciduous trees; often oaks; may include former savannas in an urban area
Enumerated_Domain:
Enumerated_Domain_Value: Oak Woodland and Savanna (Urban)
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Open Water
Enumerated_Domain_Value_Definition: Standing water for a significant part of the year
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Other Wetland (Urban)
Enumerated_Domain_Value_Definition: All other NWI sites not already classified in an urban area
Enumerated_Domain_Value_Definition_Source: Applied Ecological services
Enumerated_Domain:
Enumerated_Domain_Value: Sand/Gravel Bar Wetland
Enumerated_Domain_Value_Definition: NWI coded as "UB" or unconsolidated bottom
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Unclassified
Enumerated_Domain_Value_Definition: Insufficient data to classify

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Beginning_Date_of_Attribute_Values: 1991
Ending_Date_of_Attribute_Values: 1993
Attribute:
Attribute_Label: CROSS_URBF
Attribute_Definition: Classification with Urban Forest Class
Attribute_Definition_Source: Applied Ecological Services
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Agriculture
Enumerated_Domain_Value_Definition: Used as farmland (specific to Jackson and Johnson Counties)
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Cultivated Land
Enumerated_Domain_Value_Definition: Used as cropland
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Cultural Grassland
Enumerated_Domain_Value_Definition:
Grassland of planted domesticated grasses, or formerly cultivated land reverting to grassland and sometimes brush
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Deciduous Forest
Enumerated_Domain_Value_Definition:
Mostly closed canopy of deciduous trees, often mature; includes former savannas on south to west slopes
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Deciduous Woodland and Immature Forest
Enumerated_Domain_Value_Definition:
Open canopy of deciduous trees; often immature; may contain former savannas, or glades on soils with bedrock close to surface
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Developed Land
Enumerated_Domain_Value_Definition:
Urban and suburban land uses, including homes, businesses, roads
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Grassland
Enumerated_Domain_Value_Definition:
Grassland, often containing native wild plants; may include CRP plantings
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:
Enumerated_Domain_Value: Lowland Hardwood Forest and Woodland
Enumerated_Domain_Value_Definition: Open to closed forest canopy in flooded or wetland areas
Enumerated_Domain_Value_Definition_Source: Applied Ecological Services
Enumerated_Domain:

Enumerated_Domain_Value: Marsh and Wet Herbaceous Vegetation

Enumerated_Domain_Value_Definition:

Wetlands without a closed forest canopy; includes brush and scattered trees

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Mixed Evergreen Deciduous

Enumerated_Domain_Value_Definition:

Open to mostly closed canopy of junipers and deciduous trees; often oaks; may include former savannas

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Open Water

Enumerated_Domain_Value_Definition: Standing water for a significant part of the year

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Unclassified

Enumerated_Domain_Value_Definition: Insufficient data to classify

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Attribute:

Attribute_Label: CROSS_NOUR

Attribute_Definition: Classification without Urban Forest class

Attribute_Definition_Source: Applied Ecological Services

Attribute_Domain_Values:

Enumerated_Domain:

Enumerated_Domain_Value: Agriculture

Enumerated_Domain_Value_Definition: Used as farmland (specific to Jackson and Johnson Counties)

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Cultivated Land

Enumerated_Domain_Value_Definition: Used as cropland

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Cultural Grassland

Enumerated_Domain_Value_Definition:

Grassland of planted domesticated grasses, or formerly cultivated land reverting to grassland and sometimes brush

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Deciduous Forest

Enumerated_Domain_Value_Definition:

Mostly closed canopy of deciduous trees, often mature; includes former savannas on south to west slopes

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Developed Land

Enumerated_Domain_Value_Definition:

Urban and suburban land uses, including homes, businesses, roads

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Deciduous Woodland and Immature Forest

Enumerated_Domain_Value_Definition:

Open canopy of deciduous trees; often immature; may contain former savannas, or glades on soils with bedrock close to surface

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Lowland Hardwood Forest and Woodland

Enumerated_Domain_Value_Definition: Open to closed forest canopy in flooded or wetland areas

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Grassland

Enumerated_Domain_Value_Definition:

Grassland, often containing native wild plants; may include CRP plantings

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Marsh and Wet Herbaceous Vegetation

Enumerated_Domain_Value_Definition:

Wetlands without a closed forest canopy; includes brush and scattered trees

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Mixed Evergreen Deciduous

Enumerated_Domain_Value_Definition:

Open to mostly closed canopy of junipers and deciduous trees; often oaks; may include former savannas

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Open Water

Enumerated_Domain_Value_Definition: Standing water for a significant part of the year

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Enumerated_Domain:

Enumerated_Domain_Value: Unclassified

Enumerated_Domain_Value_Definition: Insufficient data to classify

Enumerated_Domain_Value_Definition_Source: Applied Ecological Services

Beginning_Date_of_Attribute_Values: 1971

Ending_Date_of_Attribute_Values: 2003

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Attribute_Label: ACRES

Attribute_Definition: Acreage of polygon

Attribute_Definition_Source: calculated

Attribute:

Attribute_Label: AREA

Attribute_Definition: Area in meters

Attribute_Definition_Source: calculated

Attribute_Domain_Values:

Attribute:

Attribute_Label: PERIMETER

Attribute_Definition: Perimeter in meters

Attribute_Definition_Source: calculated

Attribute_Domain_Values:

Beginning_Date_of_Attribute_Values: 1991

Ending_Date_of_Attribute_Values: 2003

Overview_Description:

Distribution_Information:

Resource_Description: ESRI GIS shape file

Distribution_Liability:

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Standard_Order_Process:

Digital_Form:

Digital_Transfer_Information:

Transfer_Size: 40.528

Ordering_Instructions:

Contact: Steve Gay Mid-America Regional Council 600 Broadway Suite 300 Kansas City, MO 64105 816/474-4240 Ext.493

Custom_Order_Process:

Contact: Steve Gay Mid-America Regional Council 600 Broadway Suite 300 Kansas City, MO 64105 816/474-4240 Ext.493 "Steve Gay" <sgay@marc.org>

Metadata_Reference_Information:

Metadata_Date: 20040908

Metadata_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Applied Ecological Services (Wisconsin Office)

Contact_Person: Jason Carlson/Neil Thomas

Contact_Position: GIS Manager

Contact_Address:

Address_Type: mailing and physical address

Address: 17921 Smith Road, P. O. Box 256

City: Brodhead

State_or_Province: Wisconsin

Postal_Code: 53520

Country: USA

Contact_Voice_Telephone: 608.897.8641

Contact_Facsimile_Telephone: 608.897.8486

Contact_Electronic_Mail_Address: jason@appliedeco.com

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

Metadata_Time_Convention: local time

Metadata_Extensions:

Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>

Profile_Name: ESRI Metadata Profile

Metadata_Extensions:

Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>

Profile_Name: ESRI Metadata Profile

Metadata_Extensions:

Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>

Profile_Name: ESRI Metadata Profile

Metadata_Extensions:

Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>

Profile_Name: ESRI Metadata Profile

Generated by [mp](#) version 2.7.33 on Wed Sep 08 20:27:57 2004

**A-3: Shape Files Used for the Kansas City NRI GIS Program
(To be Inserted at a later date)**

APPENDIX B

**USDA Soil Units and Corresponding AES Soil Types
in the Kansas City Region**

**Appendix B: USDA Soil Units and Corresponding AES Soil Types
in the Kansas City Region.**

AES Soil Type	Soil Unit Name (MUNAME)	Soil Unit (MUSYM)
Forest	KNOX COMPLEX, 18 TO 30 PERCENT SLOPES	Kn
Forest	KNOX SILT LOAM, 14 TO 20 PERCENT SLOPES	54E
Forest	KNOX SILT LOAM, 20 TO 30 PERCENT SLOPES	54F
Forest	KNOX SILT LOAM, 5 TO 9 PERCENT SLOPES	54C
Forest	KNOX SILT LOAM, 7 TO 12 PERCENT SLOPES	Kh
Forest	KNOX SILTY CLAY LOAM, 5 TO 14 PERCENT SLOPES, SEVERELY ERODED	55D3
Forest	KNOX-URBAN LAND COMPLEX, 5 TO 9 PERCENT SLOPES	61C
Forest	KNOX-URBAN LAND COMPLEX, 9 TO 14 PERCENT SLOPES	61D
Forest	LADOGA SILT LOAM, 8 TO 15 PERCENT SLOPES	091LB
Forest	MANDEVILLE SILT LOAM, 5 TO 14 PERCENT SLOPES	47D
Forest	MENFRO SILT LOAM, 2 TO 5 PERCENT SLOPES	15B
Forest	MENFRO SILT LOAM, 5 TO 9 PERCENT SLOPES, ERODED	15C2
Forest	MENFRO SILTY CLAY LOAM, 9 TO 14 PERCENT SLOPES, SEVERELY ERODED	16D3
Forest	URBAN LAND-HARVESTER COMPLEX, 2 TO 9 PERCENT SLOPES	100C
Forest	WELLER SILT LOAM, 2 TO 5 PERCENT SLOPES	19B
Thin-to- Bedrock	OSKA SILTY CLAY LOAM, 5 TO 9 PERCENT SLOPES, ERODED	22C2
Thin-to- Bedrock	OSKA-MARTIN COMPLEX, 4 TO 8 PERCENT SLOPES	7462
Thin-to- Bedrock	SNEAD-ROCK OUTCROP COMPLEX, 14 TO 30 PERCENT SLOPES	10F
Thin-to- Bedrock	SNEAD-ROCK OUTCROP COMPLEX, 5 TO 14 PERCENT SLOPES	10D
Thin-to- Bedrock	SNEAD-URBAN LAND COMPLEX, 9 TO 30 PERCENT SLOPES	65F
Thin-to- Bedrock	SOGN-VINLAND COMPLEX, 3 TO 25 PERCENT SLOPES	4752
Thin-to- Bedrock	NO NAME	103
Grassland	CHASE SILT LOAM, RARELY FLOODED	4015
Grassland	COTTER SILT LOAM, RARELY FLOODED	92
Grassland	GREENTON SILTY CLAY LOAM, 5 TO 9 PERCENT SLOPES	11C
Grassland	GREENTON-URBAN LAND COMPLEX, 5 TO 9 PERCENT SLOPES	64C
Grassland	GRUNDY SILT LOAM, 1 TO 3 PERCENT SLOPES	7251
Grassland	HIGGINSVILLE SILT LOAM, 5 TO 9 PERCENT SLOPES	2C
Grassland	HIGGINSVILLE-URBAN LAND COMPLEX, 5 TO 9 PERCENT SLOPES	63C
Grassland	MACKSBURG SILT LOAM, 2 TO 5 PERCENT SLOPES	5B
Grassland	MACKSBURG-URBAN LAND COMPLEX, 2 TO 5 PERCENT	62B

Ecological Land Cover and Natural Resources Inventory for the Kansas City Region

AES Soil Type	Soil Unit Name (MUNAME)	Soil Unit (MUSYM)
	SLOPES	
Grassland	MARTIN SILTY CLAY LOAM, 3 TO 7 PERCENT SLOPES	7302
Grassland	NAPIER SILT LOAM, 0 TO 3 PERCENT SLOPES	91A
Grassland	POLO SILT LOAM, 2 TO 5 PERCENT SLOPES	17B
Grassland	POLO SILT LOAM, 5 TO 9 PERCENT SLOPES, ERODED	7525
Grassland	POLO SILT LOAM, 5 TO 9 PERCENT SLOPES, ERODED	17C2
Grassland	SHARPSBURG SILT LOAM, 2 TO 5 PERCENT SLOPES	6B
Grassland	SHARPSBURG SILT LOAM, 5 TO 9 PERCENT SLOPES, ERODED	6C2
Grassland	SHARPSBURG-URBAN LAND COMPLEX, 3 TO 8 PERCENT SLOPES	091SB
Grassland	SHARPSBURG-URBAN LAND COMPLEX, 4 TO 8 PERCENT SLOPES	7545
Grassland	SIBLEY SILT LOAM, 2 TO 5 PERCENT SLOPES	1B
Grassland	SIBLEY SILT LOAM, 5 TO 9 PERCENT SLOPES	1C
Grassland	SIBLEY-URBAN LAND COMPLEX, 2 TO 5 PERCENT SLOPES	60B
Grassland	SIBLEY-URBAN LAND COMPLEX, 5 TO 9 PERCENT SLOPES	60C
Grassland	WIOTA SILT LOAM, RARELY FLOODED	38
Occas. Flooded	GILLIAM SILTY CLAY LOAM, OCCASIONALLY FLOODED	88
Occas. Flooded	HAYNIE SILT LOAM, 0 TO 1 PERCENT SLOPES, OCCASIONALLY FLOODED	Hy
Occas. Flooded	HAYNIE SILT LOAM, OCCASIONALLY FLOODED	83
Occas. Flooded	KENNEBEC SILT LOAM, 0 TO 1 PERCENT SLOPES, OCCASIONALLY FLOODED	7050
Occas. Flooded	KENNEBEC SILT LOAM, OCCASIONALLY FLOODED	30
Occas. Flooded	KENNEBEC SILT LOAM, FREQUENTLY FLOODED	7051
Occas. Flooded	LETA SILTY CLAY, OCCASIONALLY FLOODED	73
Occas. Flooded	MODALE SILT LOAM, OCCASIONALLY FLOODED	87
Occas. Flooded	PARKVILLE SILTY CLAY, OCCASIONALLY FLOODED	82
Occas. Flooded	SARPY FINE SAND, OCCASIONALLY FLOODED	89
Occas. Flooded	NO NAME	102
Occas. Flooded	NO NAME	69A
Hydric	BREMER SILT LOAM, OCCASIONALLY FLOODED	36
Hydric	COLO SILTY CLAY LOAM, OCCASIONALLY FLOODED	31
Hydric	MCGIRK SILT LOAM, 5 TO 9 PERCENT SLOPES, ERODED	20C2
Hydric	SAMPSEL SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES	13B
Hydric	SAMPSEL SILTY CLAY LOAM, 5 TO 9 PERCENT SLOPES	13C

Ecological Land Cover and Natural Resources Inventory for the Kansas City Region

AES Soil Type	Soil Unit Name (MUNAME)	Soil Unit (MUSYM)
Hydric	WABASH SILTY CLAY, OCCASIONALLY FLOODED	90
Hydric	ZOOK SILTY CLAY LOAM, OCCASIONALLY FLOODED	33
Water	MISCELLANEOUS WATER	M-W
Water	WATER	9999
Water	WATER	W
Disturbed	ALTERED LAND - ORIGINAL SOIL TYPE INDETERMINATE	8
Disturbed	ARENTS, EARTHEN DAM	AED
Disturbed	FILLED LAND - ORIGINAL SOIL TYPE INDETERMINATE	68C
Disturbed	FILLED LAND - ORIGINAL SOIL TYPE INDETERMINATE	68D